Test #10

1. The charge must also be balanced ✓

2. • $Cu^{2+} + 2e^- \rightarrow Cu$
   • $E^\circ = 0.337$ Volts ✓

3. • $Ba \rightarrow Ba^{2+} + 2e^-$ ✓
   • $E^\circ = 2.90$ Volts

23/24 ✓ 96%

4. The half-reaction will have to react with a substance that is positive enough to make both of the potentials positive when they are added together

5. 1. Pb^{2+} 2. Br_2 3. Pt^{2+} ✓

6. 1. I^- 2. Cd 3. Mg 4. Na ✓

7. $Sn^{2+} + 2Cu^{2+} \rightarrow Sn^{4+} + 2Cu^+$ ✓

Oxidation: $Sn^{2+} \rightarrow Sn^{4+} + 2e^-$

Reduction: $2(Cu^{2+} + e^- \rightarrow Cu^+)$

$Sn^{2+} \rightarrow Sn^{4+} + 2e^-$

$2(Cu^{2+} + e^- \rightarrow Cu^+)$

$Sn^{2+} + 2Cu^{2+} + 2e^- \rightarrow Sn^{4+} + 2e^- + 2Cu^+$

$= Sn^{2+} + 2Cu^{2+} \rightarrow Sn^{4+} + 2Cu^+$

8. $CuS + NO_3^- \rightarrow Cu^{2+} + S + NO$

Oxidation: $CuS \rightarrow Cu^{2+} + S + 2e^-$ ✓

Reduction: $NO_3^- + 3e^- \rightarrow NO$

$NO_3^- + 3e^- + 4H_3O^+ \rightarrow NO$

$(NO_3^- + 3e^- + 4H_3O^+ \rightarrow NO + 6H_2O)$ ✓

$3(CuS \rightarrow Cu^{2+} + S + 2e^-)$

$2(NO_3^- + 3e^- + 4H_3O^+ \rightarrow NO + 6H_2O)$

$= 3CuS \rightarrow 3Cu^{2+} + 3S + 6e^-$ ✓

$+ 2NO_3^- + 6e^- + 8H_3O^+ \rightarrow 2NO + 12H_2O$ ✓

$3CuS + 2NO_3^- + 8H_3O^+ + 6e^- \rightarrow 2NO + 12H_2O + 3Cu^{2+} + 3S + 6e^-$

$= 3CuS + 2NO_3^- + 8H_3O^+ \rightarrow 2NO + 12H_2O + 3Cu^{2+} + 3S$ ✓

9. $NO_2 \rightarrow NO_3^- + NO_2^-$

oxidation: $NO_2 \rightarrow NO_3^- + e^-$

$NO_2 + 2OH^- \rightarrow NO_3^- + e^-$

$NO_2 + 2OH^- \rightarrow NO_3^- + e^- + H_2O$ ✓

Reduction: $NO_2 + e^- \rightarrow NO_2^-$ ✓

$NO_2 + 2OH^- \rightarrow NO_3 + e^- + H_2O$ ✓

$+ \quad NO_2 + e^- \rightarrow NO_2^-$

$\underline{NO_2} + 2OH^- + \underline{NO_2} + e^- \rightarrow NO_3^- + e^- + H_2O + NO_2^-$

$= 2NO_2 + 2OH^- \rightarrow NO_3^- + H_2O + NO_2^-$ ✓

10. $2Br^- + F_2 \rightarrow 2F^- + Br_2$

$2Br^- \rightarrow Br_2 + 2e^-$ $\quad E^\circ = -1.0652$ volts

$F_2 + 2e^- \rightarrow 2F^-$ $\quad E^\circ = 2.87$ volts

$= 1.80$ volts ✓

$\Delta G_r = -nFE^\circ$

$= -2(96485)(1.80) = -3.47 \times 10^5$ J/mole ✓

11. $2Al + 3Zn^{2+} \rightarrow 2Al^{3+} + 3Zn$

$Al \rightarrow Al^{3+} + 3e^-$ $\quad E^\circ = 1.66$ volts

$Zn^{2+} + 2e^- \rightarrow Zn$ $\quad E^\circ = -0.763$

$= 0.90$ volts ✓

$\Delta G_r = -6(96485)(0.90) = -5.2 \times 10^5$ J/mole ✓

$\Delta G_r = -RT(\ln(K))$

$-5.2 \times 10^5 = -8.314(298)\ln(K)$

$\frac{-5.2 \times 10^5}{-2477.572} = \frac{-2477.572 \ln K}{-2477.572}$

$209.88 = \ln K$

$e^{209.88} = K$

$K = 1 \times 10^{91}$ ✓

12. • $2I^- \rightarrow I_2 + 2e^-$
• $E^\circ = -0.5355$ Volts

To oxidize I^- into I_2 the chemist should use Cl_2. ✓

13. • $Co^{2+} + 2e^- \rightarrow Co$
• $E^\circ = -0.277$ Volts

To turn Co^{2+} into Co the chemist should use Na. ✓